

Advanced Passive PWR AC-600: Development Orientation of Nuclear Power Reactor in China for the Next Century

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The nuclear power plant in the world will replace with new one in the beginning of the next century. What advanced reactor types will be utilized by nuclear power plant concerns very much for the public. In addition, the rapid development of advanced technology for coal and gas power plant also brings challenge and opportunity to the nuclear power industry. In order to search new generation nuclear power plant which is more safe, more economic and more reliable, nuclear power suppliers in the world have already offered a lot of man-power and investment for several years and got many research results, in which innovatory advanced PWR using passive safety system is the focus of world attention because of the safety and economy. Based on Qin Shan-II Nuclear Power Plant which is designed and constructed by China, we have developed passive advanced PWR AC600.

The design concept of AC600 advanced PWR NPP not only takes the real situation of China into consideration but also follows the developing trend of nuclear power in the world. The design of AC600 has the following technical characteristics:

- 1) Advanced reactor: 18~24 month fuel cycle, low leakage, low power density of the core, no any penetration on the RPV bottom head and integral reactor top structure.
- 2) Passive safety system: passive emergency residual heat removal system, passive-active safety injection system, passive containment cooling system and main control room habitability system.
- 3) System simplified and the number of components reduced.
- 4) Digital instrumentation and control system: data display, operation and control centers, protection, special monitoring, plant control and in core instrumentation systems connected through communication networks.
- 5) Modular construction, equipment quality enhanced and construction period reduced.

See in table 1 the finished experiment and research items of AC600

Table 1 The finished experimental and research items of AC600

Designation	Contents	Finish time
Critical heat flux (CHF) test at low flow rate	The coolant flow per unit area of AC600 core is relatively low. On this low-flow-rate condition, measure test data at departure from nucleate boiling on element surface and draw up a formula.	In 1993
Make-up test for make-up tanks at full pressure	Research on the passive characteristics of the make-up by a makeup tank at full pressure.	In 1997
Wind tunnel test for passive containment cooling system	Research on the correlation between flow resistance, flow duct shape and flow rate of the passive containment cooling system, and research on natural convection cooling characteristics	In 1994
Test for the passive emergency core residual heat removal system on the secondary side	research on the capability of the emergency core residual heat removal system on the secondary side, on the flow characteristic of the natural circulation and on the supporting means	In 1995
Flow characteristics test of the baffle plate in the exit plenum of SG	research on the flow characteristics of the baffle plate in the exit plenum of the AC600 SG and the entrance plenum of the main pump	In 1995
Digital I&C systems	Research on the control, adjustment and in-core measurement (pneumatically-driven balls measurement)	In 1995

Moreover, the Ferro-water reflector test and the neutron irradiation research of Gd_2O_3 burnable poison element will be conducted very soon.

AC600 not only inherit the proven technology which China has had, but also possess bright features brought forth new ideas by ourselves. Therefore, AC600 are hoped to act as development direction of nuclear power type of China in the next century. This paper mainly introduces the background, technical and economic behaviors, research results and application prospect of AC600.

Key words: Passive safety, evolutionary and innovatory advanced PWR, Digital instrumentation and control system, Modular construction.